A Section 508–conformant HTML version of this article is available at https://doi.org/10.1289/EHP2470.

Unwell: The Public Health Implications of Unregulated Drinking Water

Nate Seltenrich

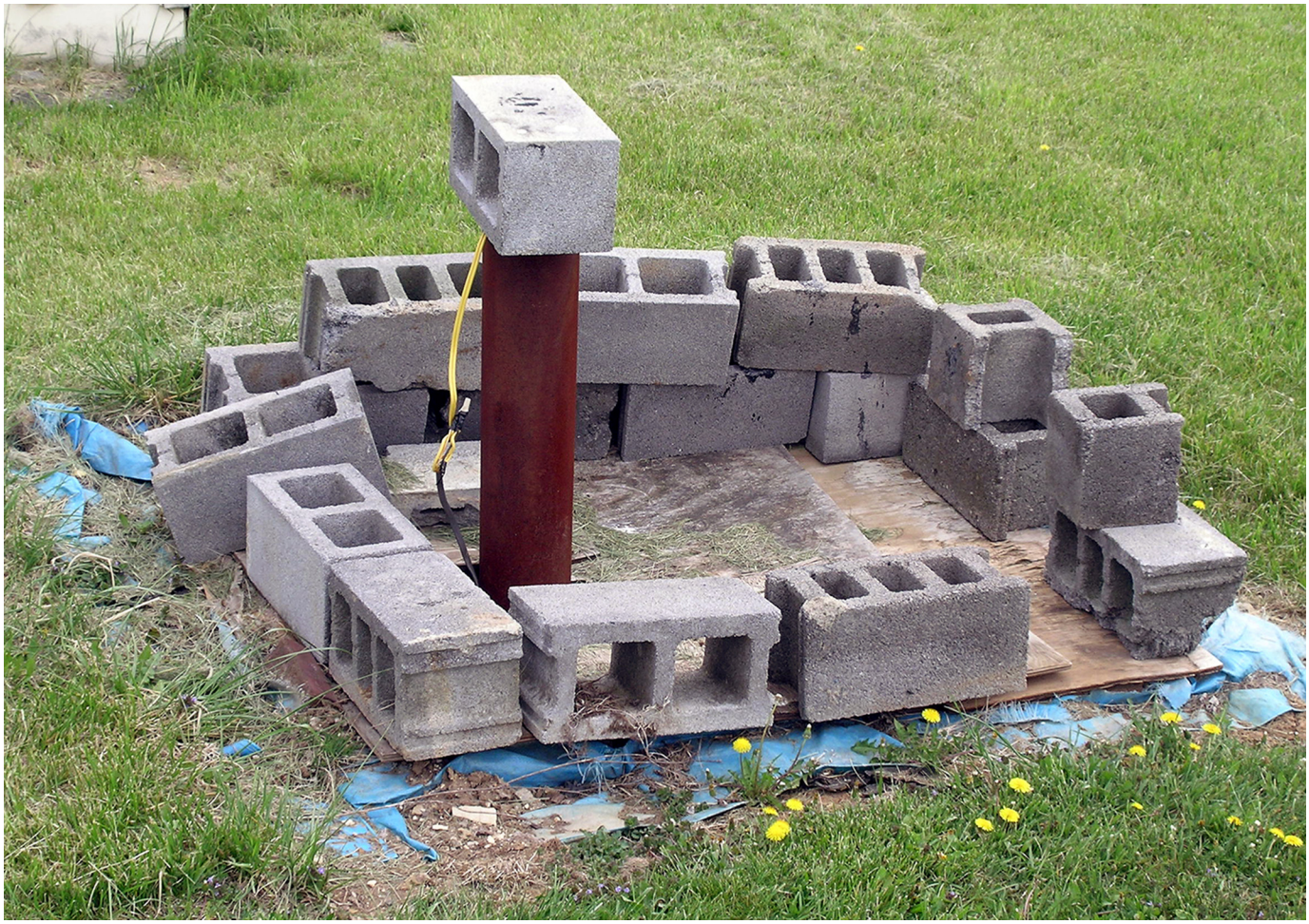
https://doi.org/10.1289/EHP2470

Roughly one in seven U.S. residents relies on a private well for drinking water.[1] Unlike the rest of the population served by the nation's many public water systems,[2] these 44.5 million Americans are not protected by the federal Safe Drinking Water Act,[3] which regulates 87 biological and chemical contaminants.[4] This has significant implications for public health, according to the authors of a new review in *Environmental Health Perspectives*,[5] and although solutions exist for ensuring that well water is safe to drink, it is unclear how and whether they can be implemented.

At best, private wells receive minimal oversight from local and state authorities, such as limited testing upon installation and, in some states, when properties change hands, write authors Jacqueline MacDonald Gibson of the University of North Carolina at Chapel Hill and Kelsey Pieper of Virginia Polytechnic Institute and State University. Many wells escape regulation altogether, leaving the onus entirely on individuals to screen for pollutants and to mitigate them when they are discovered.[6]

Although precise statistics are not available, most well owners do not perform or pay for recommended tests at regular intervals, MacDonald Gibson says. This neglect is partly due to a simple lack of knowledge: "A lot of people assume that if their water looks and tastes okay, that the water is safe," she says. But common contaminants such as bacteria, arsenic, and nitrate are colorless, odorless, and tasteless, and they can easily go undetected.[7,8,9]

Cost can be another barrier to keeping well water safe. Testing for volatile organic compounds, pesticides, metals, nitrate, bacteria, and radioactive contaminants could exceed $500, says Lynda Knobeloch, a former toxicologist with the Wisconsin Department of Health Services who was not involved with the paper. Effective in-home filters can cost hundreds to thousands of dollars, and well replacement can cost $10,000 or more, Knobeloch says. Furthermore, in some states, including Wisconsin, well contamination must be disclosed upon the sale of the home, providing an additional disincentive for some homeowners to ever test at all.



This poorly constructed and largely unprotected well tested high for fecal coliforms. But even a state-of-the-art well can produce unsafe water without routine maintenance, testing, and treatment when necessary. Having a septic system nearby only increases the risk. Image: © Bryan Swistock/Pennsylvania State University.

Many people who use private wells are left potentially exposed to harmful pollutants. In a 2013 study of nearly 4,000 private wells in rural Wisconsin, for example, Knobeloch found that 47% exceeded at least one health-based water quality standard.[10] And a recent study in North Carolina led by MacDonald Gibson found that between 2007 and 2013, 99% of emergency department visits for acute gastrointestinal illness caused by microbial contamination of drinking water were associated with private wells.[11]

The new review focused on North Carolina, where 35% of the population relies on private wells (the third most of any state),[3] and 3.2 million people live in rural areas (the second most of any state).[12] Furthermore, a history of racial segregation and what is known as "municipal underbounding"—in which expanding cities engulf poor and minority communities without affording them city services—has left many black residents of North Carolina's periurban areas without access to public water systems, even if adjacent newer neighborhoods are fully connected.[13]

Because underbounded communities often also lack sewer service, the authors suggest that residents run the risk of contaminating their own water with fecal organisms, particularly in higher-density areas. "There are little pockets of people with old and failing septic systems in their backyard and a well nearby, and there may be a water line across the street," says MacDonald Gibson.

To help address these challenges in North Carolina and beyond, the Research Triangle Environmental Health Collaborative, an alliance of government, academic, industry, and public-interest groups, held a two-day summit in October 2015. The new review outlines findings and recommendations from this summit, which include developing a state database of private well locations, funding studies to identify areas underserved by municipal water and sewer systems, and providing additional support and resources to individuals for monitoring and maintenance.

Knobeloch says the recommendations are sensible, if not necessarily innovative. A number of these recommendations have already been embraced by states including New York and Minnesota, whereas others, such as fully annexing underserved communities to extend city services, are unlikely to work for political and economic reasons.

One additional improvement she believes should have been included is discouraging the development of new communities without central sewer and water systems. "You can prevent more of the problems you already have," she says.

The review highlights important and in some cases universal challenges with private wells, says Bryan Swistock of Pennsylvania State University, who has studied water resources and well water quality extensively in his home state and was not involved in the review. "It agrees so much with what we've seen here over thirty years," he says. "There needs to be a better recognition that private water wells are a really critical part of the nation's infrastructure. But they are mostly ignored by the government because they are viewed as a private property issue."

Nate Seltenrich covers science and the environment from Petaluma, California. His work has appeared in *High Country News*, *Sierra*, *Yale Environment 360*, *Earth Island Journal*, and other regional and national publications.

References

1. U.S. Geological Survey. 2017. Domestic Water Use. https://water.usgs.gov/edu/wudo.html [accessed 29 September 2017].
2. U.S. Environmental Protection Agency (EPA). 2015. "Providing Safe Drinking Water in America: 2013 National Public Water Systems Compliance Report." EPA Document 305R15001. Washington, DC: U.S. Environmental Protection Agency. https://www.epa.gov/sites/production/files/2015-06/documents/sdwacom2013.pdf [accessed 29 September 2017].
3. Maupin M, Kenny J, Hutson S, Lovelace J, Barber N, Linsey K. 2014. "Estimated Use of Water in the United States in 2010." U.S. Geological Survey Circular 1405. Washington, DC: U.S. Department of the Interior; U.S. Geological Survey. https://pubs.usgs.gov/circ/1405/pdf/circ1405.pdf [accessed 29 September 2017].
4. U.S. EPA. 2017. Ground Water and Drinking Water: National Primary Drinking Water Regulations. https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants [accessed 29 September 2017].
5. MacDonald Gibson J, Pieper KJ. 2017. Strategies to improve private-well water quality: a North Carolina perspective. Environ Health Perspect 125(7):076001, PMID: 28728142, https://doi.org/10.1289/EHP890.
6. U.S. EPA. 2017. Private Drinking Water Wells. https://www.epa.gov/privatewells [accessed 29 September 2017].
7. PennState Extension. 2017. Lead in Drinking Water. http://extension.psu.edu/natural-resources/water/drinking-water/water-testing/pollutants/lead-in-drinking-water [accessed 29 September 2017].
8. U.S. EPA. 2016. Drinking Water Requirements for States and Public Water Systems. Chemical contaminant rules. https://www.epa.gov/dwreginfo/chemical-contaminant-rules [accessed 29 September 2017].
9. Minnesota Department of Health. 2017. Nitrate in Well Water: Well Management Program. http://www.health.state.mn.us/divs/eh/wells/waterquality/nitrate.html [accessed 29 September 2017].
10. Knobeloch L, Gorski P, Christenson M, Anderson H. 2013. Private drinking water quality in rural Wisconsin. J Environ Health 75(7):16–20, PMID: 23505770.
11. DeFelice NB, Johnston JE, Gibson JM. 2016. Reducing emergency department visits for acute gastrointestinal illnesses in North Carolina (USA) by extending community water service. Environ Health Perspect 124(10):1583–1591. (2016), PMID: 27203131, https://doi.org/10.1289/EHP160.
12. U.S. Census Bureau. 2012. 2010 Census Urban and Rural Classification and Urban Area Criteria. https://www.census.gov/geo/reference/ua/urban-rural-2010.html [accessed 29 September 2017].
13. Lichter DT, Parisi D, Grice SM, Taquino M. 2007. Municipal underbounding: Annexation and racial exclusion in small Southern towns. Rural Sociol 72(1):47–68, https://doi.org/10.1526/003601107781147437.